was elected F.R.S. During his short stay at Durham he communicated results of his observations of minor planets to the Royal Astronomical Society, following them up with further contributions, and was elected a fellow of the society in 1864. Soon after succeeding Glaisher in 1875, he became a fellow of the Royal Meteorological Society, and was president in 1886 and 1887, also serving as official referee for papers for nearly thirty years.

The most important Greenwich publication associated with Ellis's name is that which deals exhaustively with air temperature for fifty years, 1841–90, in the production of which he did a very great amount of hard work in rendering the earlier observations comparable with those taken under his own superintendence. But he is probably better known in connection with his contribution to the Philosophical Transactions of the Royal Society for 1880, in which he showed for the first time a relation between sun-spot frequency and terrestrial magnetic disturbance, a subject which he followed up with further contributions to the R.A.S. Monthly Notices. He strongly objected to the notion that the moon affects the weather, and so long ago as 1867 maintained in the *Philosophical Magazine* that the idea of the moon's clearing away clouds was nothing but a poet's fancy. To the subject of cloudiness he returned later, dealing in one of his presidential addresses to the Royal Meteorological Society with seventy years' cloud observations at Greenwich. His association with the Time Department is reflected in a highly interesting article in the Monthly Notices of the Royal Astronomical Society dealing with the rating of several clocks destined for use during the observations of the transit of Venus in 1874, in which he showed that the oscillation of one pendulum was distinctly affected by that of another in the vicinity, especially if the clocks were mounted on the same stand.

Ellis was a frequent contributor also to the Quarterly Journal of the Royal Meteorological Society, and for many years a member of the Institution of Electrical Engineers, in connection with which he investigated the effect of the City and South London Electric Railway trains on the earth-current registers at the Royal Observatory. He was keenly interested in the new magnetic instruments introduced at Greenwich by the present Astronomer Royal, which he was unfortunately unable to see for himself, as his sight had practically failed for some years before his death. He insisted to the last on attending the annual visitation of Greenwich Observatory, putting in his seventy-fifth consecutive appearance at that function last June, but no one who saw him then can be surprised that it was his last visitation day. He was able to appreciate a reference in the current issue of the *Observatory* magazine only a few days before his death, but had been for some weeks confined to his bed, though suffering from no specific ailment of any great importance. Though twice married he had no children, but he leaves a widow. He was buried at Charlton Cemetery on Saturday, December 16. W. W. B.

NOTES.

BY the will of the late Mr. Percival Lowell, a fund amounting to 10 per cent. of the income of his total estate of a million dollars is set apart for the maintenance of the Lowell Observatory at Flagstaff, Arizona, to be used especially for "the study of our solar system and its evolutions." It is specified that the observatory is never to be merged or joined with any other institution. The fund devoted to this purpose is to be held in trust by the late astronomer's brother-in-law, Mr. W. Lowell Putnam.

WE regret to announce the death on December 14, at seventy-three years of age, of Prof. T Purdie, F.R.S., emeritus professor of chemistry in the University of St. Andrews.

CAPT. C. BATHURST has been appointed Parliamentary Secretary of the Food Control Department in the new Ministry, and not of the Board of Agriculture, as was expected last week. This office is held by Sir R. Winfrey, who occupied the same post in 1906–10, when Earl Carrington was Minister of Agriculture.

THE death is announced of Dr. Hugo Münsterberg, since 1892 professor of psychology, and director of the psychological laboratory, Harvard University.

MR. W. KEWLEY has been appointed secretary-superintendent of the Middlesex Hospital in succession to the late Mr. F. Clare Melhado.

DR. A. YERSIN, director of the Pasteur Institute of Indo-China, has been awarded the Lasserre prize for the present year for his work on anti-plague serum.

IT is announced in the issue of *Science* for November 17 that the American Academy of Arts and Sciences on November 15 presented the Rumford medals to Dr. C. G. Abbot, of the Smithsonian Institution, for his researches on solar radiation.

WE learn from the *Times* that Sub-Lieut. O. J. Hobbs, previously reported missing, is now reported killed on or about November 13. At the outbreak of war he was science master at the King Edward VI. Grammar School, Southampton. Announcement is also made that Lieut. J. C. Simpson, R.E., an associate of the Royal School of Mines and a fellow of the Geological Society, was killed on December 4.

WE regret to note that *Engineering* for December 15 records the death, on December 11, in his sixty-fourth year, of Mr. Archibald Colville, the chairman of Messrs. David Colville and Sons, Ltd., the well-known steel-makers of Motherwell. Mr. Colville was chairman of the Scottish Steel Makers' Association, and was a member of the Board of Trade Iron and Steel Industries Committee.

A FUND is being raised to purchase the very valuable scientific library of the late Prof. Silvanus Thompson and to present it to the Institution of Electrical Engineers as a memorial of his life and work, the library to be accessible to the public on the same conditions as the Ronalds Library. Those who wish to subscribe to this fund or to have further information regarding it are requested to communicate with Mr. W. M. Mordey, 82 Victoria Street, London, S.W.

AT a recent meeting of the Anatomical Society of Great Britain and Ireland the following members were appointed to edit and manage the *Journal of Anatomy*:—Prof. T. H. Bryce, University of Glasgow; Prof. E. Fawcett, University of Bristol; Prof. J. P. Hill, University College, London; Prof. G. Elliot Smith, University of Manchester; and Prof. A.

Keith, Royal College of Surgeons of England—the last-named to serve as acting editor. At the same meeting a unanimous vote of thanks was given to Prof. Alex. Macalister, F.R.S., for the able manner in which he had managed and edited the *Journal* in past years and for his generosity in transferring its control to the Anatomical Society.

AN expedition in the interests of the Smithsonian Institution will leave shortly for the French Congo and certain of the neighbouring parts of West Africa. It will be known as the "Collins-Garner Congo Expedition, in the interests of the Smithsonian Institution," and will be headed by Mr. A. M. Collins, of Philadelphia, a well-known explorer and sportsman, who has made several trips to Africa and other regions in search of big game. Mr. R. L. Garner, of New York, who has already made extensive investigations concerning the apes and monkeys of Central Africa, is manager of the expedition. The other members of the party are Prof. C. W. Furlong, of Boston, and Mr. C. R. W. Aschemeier, of Washington, who represents the Smithsonian Institution as collector of natural history specimens for the United States National Museum. The natural history collections will go to the United States National Museum.

THE trustees of the Elizabeth Thompson Science Fund announce their readiness to consider applications for grants in aid of scientific work. Appropriations are restricted to non-commercial enterprises, and are intended solely for the actual expenses of the investigation, not for the support of the investigator or for the ordinary costs of publication. Grants are made only for those researches, not otherwise provided for, the object of which is, broadly, the advancement of human knowledge; requests for researches of a narrow or merely local interest will not be considered. Usually grants are not made in excess of three hundred dollars. Applications for grants from this fund should be accompanied by a full statement of the nature of the investigation, of the conditions under which it is to be prosecuted, and of the manner in which the appropriation asked for is to be expended. The application should be sent to the secretary of the board of trustees, Dr. W. B. Cannon, Harvard Medical School, Boston, Mass., U.S.A., who will furnish further details.

MUCH is being done all over the country to provide entertainment for our soldiers, but the Scientific Society of the Birmingham and Midland Institute appears to have opened up a somewhat new line. On a recent evening many members and friends of the society visited the Y.M.C.A. Hut at Sutton Coldfield to give the convalescents stationed there a "Popular Science Evening." The tables were crowded all the evening, and the soldiers evinced the greatest interest in the exhibits and experiments. Exigencies of time had been carefully considered, so that the preparations in the room took only about half-an-hour, whilst an even shorter time served for clearing away. The following list of some of the exhibits may be a useful guide to other societies desirous of organising similar exhibitions:—"Rainbow Cup," showing colours of very thin soap films; Cartesian diver; radiometer; spontaneous combustion; shocking coil; fire from flint, steel, and tinder; floating magnets under a controlling magnet; diffusion figures, formed by the spreading of dyes in blotting paper; harmonigraph (four-phase); several microscopes; gyroscope, spinning eggs, etc.; resonance experiments with tuning forks, resonators, swinging balls, etc.; soap bubble experiments.

IN an address before the opening meeting of the Illuminating Engineering Society on December 15 Mr. L. Gaster referred to the great loss which the society had sustained in the death of Prof. Silvanus P. Thompson. A message of condolence from the Russian Electrotechnical Association, expressing admiration of Prof. Thompson's great gifts, was also read. The address dealt mainly with the problem of war economies in lighting, which, it was suggested, should take the form of avoiding waste of light rather than aiming at indiscriminate diminution. The prejudicial effect of the darkening of the streets was illustrated by the progressive increase in the number of accidents during the past few years, and the economic loss involved in the interference with traffic was considerable. The present methods of screening lamps were in general uneconomical and badly devised, and the conditions varied greatly in different districts. These anomalies appeared to be due to the conflicting claims of different authorities urging respectively the claims of economy, the convenience of traffic and safety, and precautions against hostile aircraft. After two years of war the time was surely ripe for a systematic study of the present lighting conditions and for the establishment of a central authority, acting under expert advice, to determine how these various requirements could best be met.

MR. J. REID MOIR has sent us, as an excerpt from the Proceedings of the Prehistoric Society of East Anglia (vol. ii., part ii., for 1915–16), a paper on a series of pre-Palæolithic implements recently discovered at Darmsden Hall, Suffolk, a place about eight miles north-west of Ipswich. The sand underlying the pebble-bed is at present undatable, but the deposit was laid down prior to the excavation of the Gipping Valley, and the pebbles were deposited from the Woolwich and Reading beds. These Darmsden implements, which are precisely the same as the sub-Crag specimens, are more ancient than the Pliocene Red Crag, and can therefore be referred to an early phase of the pre-Palæolithic period. The human origin of the chipping is said to be certain. There is no evidence that they were fractured in the bed in which they are now found, and they show no signs of pressure flaking or scratches, the result of moving pressure. They have obviously been flaked by blows, and the angles at which the flakes were moved show that such blows were intelligently directed.

IN the *Psychological Review* (vol. xxiii., No. 6) K. S. Lashley raises the problem of the importance of the human salivary reflex. He points out that the experiments of Pawlow have provided a method of investigation which has proved useful in the study of the sensory physiology of animals, and promises to be even more valuable in revealing fundamental factors of habit formation and of central inhibition and reinforcement. He suggests that an extension of the method to man is desirable, as in the few attempts already made to investigate the conditioned salivary reflex in man the results are not in harmony with one another, due probably to differences in technique and interpretation. The ease with which the quantity of secretion of the salivary glands can be measured, the consistency of their reactions, and their relative freedom from inhibition, make them especially promising for studies of the relation of the intensity of the stimulus to the organism, which studies have hitherto been restricted to the elaboration of the laws of psycho-physics.

A SYSTEMATIC entomological paper of much interest is one on the Dermaptera and Orthoptera of the coastal plain and piedmont region of the south-eastern United States by J. A. G. Rehn and M. Hebard (Proc. Acad. Nat. Sci., Philadelphia, lxviii., part 2).

The district studied extends over Virginia, the Carolinas, Georgia, and northern Florida, ranging from the Appalachian summits to the sea-level. Lists of species characteristic of the various regions are given, and in the systematic part of the paper variation is studied so far as possible in relation to geographical conditions.

"A SYSTEMATIC Account of the Prairie-Dogs, by N. Hollister, has lately been issued (No. 40, "North American Fauna," U.S. Dept. Agric. Biol. Survey). The genus Cynomys is divided into two subgenera and five species, in the descriptions of which nearly 900 specimens have been utilised. There are comparative photographs of skulls and distributional maps. It seems a pity that in valuable zoological memoirs such as this the ridiculous misnomer "dog" should be stereotyped for these animals, which, according to the author, are "true ground-squirrels, or spermophiles."

A CATALOGUE of the earthquakes felt in the Philippine Islands in the year 1915 has recently been published in the U.S. Weather Bulletin. The number of shocks recorded during the year is 170, only forty-eight of which reached the degree 4, or a higher degree of the Rossi-Forel scale, though fifty-seven were registered at the Manila Observatory. One earthquake, which occurred on March 12 in south-east Luzon, though it attained an intensity of only 6–7 (that is, of less than destructive intensity), disturbed an area of about 45,000 square miles, and was recorded at seismological observatories all over the world.

CAPT. GOURLAY's note on a phosphorescent centipede, recorded in NATURE of November 23 (p. 233), has elicited some further facts worth putting on record. They have been sent us by Mr. S. Priest, hon. sec., Dartford Naturalists' Field Club, and relate to the experiences of members of the club residing at Stone and Dartford. He cites two cases of centipedes, seen during October and November, emitting a trail of light as they crawled along, and exuding phosphorescent matter on to the fingers when handled. Another specimen left "trail-like drops of green light" behind it. The light in this case was so brilliant as to show through the handkerchief in which it was placed after capture. Finally, Mr. Priest cites a case of this luminosity persisting in a crushed specimen.

THE purification of oyster-beds by means of chlorinated water has formed the subject of experiment by the Board of Fish and Game Commissioners, California. According to *California Fish and Game* (vol. ii., No. 4), a trace of calcium hypochlorite can be passed through the gills and alimentary canal of the oyster without any detrimental effect upon the animal, while any water-borne disease, such as typhoid, is effectually destroyed. In the same issue it is urged that more use should be made of the immense quantities of the edible mussel to be found along the rocky shores of Humbolt County. Not only, it is insisted, do they provide a most nutritious food when eaten in the fresh state, but they are scarcely, if at all, less palatable when pickled. Finally, protective measures have been framed for the "Alabone," or Haliotis, which has been almost exterminated for the sake of its shell. It is urged that this mollusc can be made to produce pearls of extreme beauty by inserting foreign bodies between the mantle and the shell.

BULLETIN No. 61 of the Agricultural Research Institute, Pusa, gives an interesting review by Mr. A. Howard of the bearing of soil aeration upon crop production, with especial reference to the agriculture of India. Striking illustrations of the importance of this factor have been furnished by the experimental work of recent years in that country. The requirements of nodule-producing leguminous crops for supplies of nitrogen and oxygen in the soil render soil aeration a factor of obvious importance in their growth, and experience with the gram and indigo crops and in the general practice of green manuring fully bears this out. The distribution of gram in India follows the occurrence of well-aerated soils. Experiments at Pusa have demonstrated that the growth of gram in deficiently aerated soil can be greatly improved by the simple expedient of incorporating considerable quantities of tile fragments with the soil. The indigo plant provides an even more striking instance of dependence upon soil aeration, and much of the money expended in attempts to improve the production of natural indigo might have been saved had more attention been paid to the needs of the plant in this respect. Soil aeration has been shown also to have an important bearing upon the maturation and quality of grain, fruit, vegetables, and tobacco. Various practical applications of soil aeration are indicated, including more rational irrigation, manuring, improvement of crops and cattle, and the development of wheat and rice areas. With efficient aeration adequate nitrogen supplies can be derived directly from the air by bacterial activity, whilst soil fungi will liberate supplies of available phosphates and potash.

THE twelfth memorandum of the Health of Munition Workers Committee deals with the output of munition workers in relation to hours of work, and the question has been investigated from a statistical point of view by Dr. H. M. Vernon. It was found that, when the number of working hours per week was increased beyond a certain level, the output was not correspondingly increased, but tended to fall off owing to the occurrence of "broken time" from sickness or fatigue. The number of working hours per week which yielded the maximum output varied with the character of the work. For moderately heavy labour, the maximum output was attained with sixty hours' work a week, whereas those engaged in light labour worked as much as seventy hours a week in order to reach their maximum output. Dr. Vernon points out that the production of a maximum output day after day by the worker must impose a considerable strain, and that in many cases the strain became too great to be borne and the worker had to drop out altogether. Hence the optimum length of the working week, suited for peace times, is considerably shorter than that mentioned, although the principle of graduating the number of hours to the type of work performed still holds good. The memorandum also gives instances of considerable delay in starting the day's work and of a similar slackening just before the day's work ceases, and it is pointed out that the elimination of these causes of lost time would increase the worker's output without lengthening his working day.

THE September number of *Terrestrial Magnetism and Atmospheric Electricity* contains the results of the measurements of the deviation of the magnetic compass from true north made by the survey ship *Carnegie* during her circumnavigation of the Antarctic continent between December, 1915, and June, 1916. The great bulk of the observations relate to latitudes between 50° and 60° south, but in the neighbourhood of Australia many observations were taken north of this belt. According to the new survey, the British Admiralty Chart gives the deviation to the west in the South Atlantic a fraction of a degree too great, and the error south of the Cape of Good Hope rises to 6° In the south of the Indian Ocean the chart over 10°

of longitude gives the deviation to the west 3° too small. South-west of Western Australia it is in error by 10° in the same direction. South of Australia it agrees with the new observations to within a small fraction of a degree. East of New Zealand there are a few points where the deviation to the east is given in the chart a degree or more greater than it is. In the middle of the South Pacific there is a considerable region over which the chart gives the deviation to the east 2° or 3° too small, while south of Cape Horn it is in fair agreement with the new observations.

IN an address recently delivered to the Western Section of the Institution of Electrical Engineers, the chairman, Dr. D. Robertson, compared the field of scientific knowledge to a goldfield. The first-comers acquire the surface veins and nuggets with comparative ease and with the crudest equipment, but their successors must expend more and more preliminary labour without immediate result, and they must possess more and more knowledge if these labours are not to prove abortive. In the field of research we are past the first stage, and the investigator now must go through a long preliminary training and have behind him resources sufficiently great to support him during the non-productive period. We shall, Dr. Robertson said, never get a sufficient number of men of the right temperament until we offer them prospects comparable with those open to the other learned professions. Dr. Robertson insisted also on the necessity of the scientific man keeping in constant touch with the manufacturing side, if only by weekly visits to the workshops and chats with the managers and foremen. The remainder of his address was devoted to a consideration of new sources of energy for the time when our coalfields are exhausted. He estimated that a dam eight miles long across the Bristol Channel would furnish a million kilowatts of tidal power, and that one at a lower part, thirty miles wide, would give ten million kw. Another suggestion he put forward for consideration was that we should "grow our fuel"—that is to say, produce a plant of high calorific value suitable for use directly as fuel, or indirectly by distilling alcohol or other spirit from it, or, better still, by taking up the energy electrically from the plant so as to save the thermodynamic losses of the heat engine.

THE Hardness Tests Research Committee of the Institution of Mechanical Engineers presented a report on November 17 giving particulars of tests made at the National Physical Laboratory by Dr. T. E. Stanton. After some preliminary investigations, it was decided to devise a wear test which would apply to cases in which the relative movement of the surfaces was considerable, and thus enable results to be obtained which would give information regarding shafts, or pins, working at high speeds under heavy loads. In the machine used, the specimen (diameter d) was revolved, and the load applied by means of an abrading ring (internal diameter D); by means of an Oldham coupling, both specimen and ring revolved at the same speed, hence in each revolution the slip of the ring over the specimen was $\pi(D-d)$. Abraded particles were removed by a strong air-blast. The wear was expressed as thickness of surface layer worn away in mils per 1000 ft. of slip, and the relative resistance to sliding abrasion as the reciprocal of this number. The results of the entire investigation show that the Brinell hardness number divided by 6 is approximately equal to the scleroscope number; the characteristic which distinguishes sliding abrasion from rolling abrasion is that the former does not cause any perceptible hardening of the surface under wear as the test proceeds. Comparison of the results for the resistance to sliding abrasion with the Brinell hardness numbers shows that the Brinell numbers are not a safe guide in predicting relative resistances to wear of a miscellaneous selection of steel. The report forms a valuable contribution to our knowledge of this important practical subject.

ON Friday, December 15, the inaugural address to the Royal College of Science Chemical Society was delivered by Prof. Gilbert T. Morgan, the subject of his lecture being "Synthetic Chemistry and the Renascence of British Chemical Industry." Prof. Morgan congratulated the society on having this year reached its twenty-first anniversary, and referred to the developments which had taken place in the Royal College of Science since the foundation of the society by Sir William Tilden in 1895. Affiliation with the Imperial College of Science and Technology had given an increased bias to the college curricula in the direction of applied science, and the war had since revolutionised existing ideas as to the national importance of synthetic chemistry. Two chemical crises had arisen; first, the industrial dislocation produced by the stoppage of German dyes; and, secondly, the shortage of high explosives. These crises pointed the same moral, the vital importance to the nation of a well-organised coal-tar industry. This essential development can be attained only by the employment of large staffs of well-trained chemists. The prizes of the chemical profession will be greater, but the competition keener, than has hitherto been the case. The student can best prepare for this strenuous struggle by undergoing a thorough training in analytic and synthetic chemistry. On the practical side, he should aim at perfection in all the laboratory arts. On the theoretical side, he should endeavour to acquire that particularly chemical outlook sometimes termed "the chemical instinct," which is gained by a careful study of molecular theories of constitution, and especially of stereochemical relationships. If time permits, some knowledge of the industrial applications of chemical products will be a valuable addition to his fund of knowledge, and an acquaintance with the elements of mechanics and machine design will tend to render more harmonious his relations with his future works colleague, the engineer. The value of researches in synthetic chemistry, both inorganic and organic, was emphasised by many instances of recent date. Chemical synthesis moves forward unceasingly, and progress over one difficulty leads to many fresh advances at different points along the line. In order to ensure the willing co-operation of many trained workers, it will be necessary to introduce the collegiate spirit into our chemical factories and technical laboratories, so that the splendid team work displayed by our new armies in the field may be rendered available for industrial developments.

THE first number of *Air*—the official organ of the Aeronautical Institute of Great Britain—has just been issued. It is hoped that this publication may stimulate public interest and encourage the study of aeronautics. Articles are included on the Air Board, by L. Blin Desbleds; on the cost of a pre-war aerial misconception, by A. J. Liversedge; and on the steel construction of aeroplanes, by G. C. Loening.

THE following volumes have been arranged for, for appearance in the "Fauna of British India" Series (London: Taylor and Francis):—"Butterflies (Lycœnidæ and Hesperiidæ)," H. H. Druce; the "Longicorn Beetles," C. J. Gahan; the "Ixodidæ and Argasidæ," C. Warburton; "Leeches," W. A. Harding; the "Brachyurous Crustacea," Lieut.-Col. A. Alcock; the "Apterygota, Termitidæ and Embiidæ," A. D. Imms; the 'Diptera Brachycera," E. Brunetti; the "Rutelidæ," G. J. Arrow, and the "Operculata," G. K. Gude.